Effect of Video-Taped Instruction and Gender on Senior Secondary Students' Performance in Physics Practical in Port- Harcourt, Rivers State, Nigeria

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Abstract: **This study was carried out to investigate the effect of video-taped instruction and gender on Senior Secondary Students' performance in practical physics. The design for the study is quasi-experimental, of the type, pretest-posttest control group design. The population of the study comprised of all SS3 physics students in Port Harcourt Local Government Area of Rivers State. One hundred and three (103) students in 2 co-educational schools made up the sample size. Two groups namely the experimental group and control group were used for the study. The experimental group was taught practical physics using video-taped instruction (VTI) while the control group was taught practical physics using the conventional (real handling of apparatus) teaching method (CM). Two research questions and two hypotheses were formulated to guide the study. The instrument used for the study was Physics Practical Skills Rating Scale (PPSRS). The data were analyzed using mean and standard deviation to answer the research questions while t-test and two-way analysis of variance (2 x 2 – ANOVA) were used to test the hypotheses at 0.05 level of significance. The findings of the study revealed that use of video-taped instruction does not have any significant effect on gender. The following recommendations, among others were also made : that video-taped instruction as a method of teaching should be included in the physics curriculum because it raised students' interest thereby improving performance irrespective of gender, use of ICT facilities and modern instructional materials should be encouraged in our schools, use of video taped instruction by teachers and students in the classrooms should be encouraged, teachers should be trained and retrained through in service programmes, workshops, conferences and seminars to keep them abreast with modern innovative teaching strategies. Implication of this study is that if VTI is fully implemented in our physics classes which improves performance irrespective of gender, there will be adequate manpower to provide for functional living in the society**.

I. INTRODUCTION

Physics is a natural science that involves the study of matter and its motion through space (Olumuyiwa & Okunola, 2007). More broadly, it is the general analysis of nature, conducted in other to understand how the universe behaves. The aim of Physics learning in schools is to bring about the technological development needed by the nation through the production of young scientists who would be able to produce the technological devices to make day- to -day activities easier and living more comfortable (Federal Ministry of Education,1985; Federal Republic of Nigeria, 2007).

The effects of Physics can be felt in all areas of human activity. The clinical thermometer, x-ray machine, airplane, bicycle, car, camera, radio and television are a few of the many inventions and discoveries of man which require knowledge of Physics for their understanding. Many natural phenomena such as the eclipse, rain, thunder and lightning also find explanation in Physical principles (Olumuyiwa *et al*., 2007). The unraveling of the DNA structure and the subsequent genome project required a significant input from physics techniques (Stanley, 2000). Musasia, Ocholla and Memba (2012) also listed some contributions of Physics to the society as follow: a wide variety of treatment techniques made possible by the discovery of radioactivity and other high frequency radiations exist; continuing research into challenges posed by diseases such as cancer, Ebola, and HIV/AIDS, and presently COVID-19 will require the development of high precision equipment employing physics principles; Computers, mobile phones and their attendant spin-off technologies show the indispensability of Physics; and the current fixation with information communication technologies (ICTs) could not have occurred without the primal physics discovery of the transistor. Also Cambell (2006) as cited in Musasia *et al* (2012) reiterated that electromagnetism is vital in the generation of electricity, mobile phone communication, optical and satellite communication, portable electronics, radio and radar perception, and X-ray crystallography.

From the foregoing, it cannot be disputed that physics education has a direct bearing on the attainment of technological development in any society. For any meaningful and useful technological development to be experienced in our society therefore, the physics curriculum must be well and totally implemented and its concepts must be adequately and effectively taught in our secondary schools.

Physics education refers both to the methods currently used to teach physics and to an area of pedagogical research that seeks to improve those methods (Holzner, 2006). Physics education is encountering a lot of challenges in the face of varieties of scientific, technological, engineering and mathematical trauma, which seems to have become a great threat to human knowledge and survival in the world today (Owolabi & Oginni, 2013). The unique role of physics education as a tool for enhancing science teaching need to be reinvigorated for total over hauling in education sector and modern technology.

For Physics to be taught properly and effectively, laboratories must be an integral part of the Physics curriculum. Musasia (2016) found out that students involved in intensive practical activities have a positive influence on student's achievements in physics. This is corroborated by Omeodu (2018) whose study shows that the respondents perceived physics practical work as an activity that helps teachers/students master the content through investigations and observations, promotes teachers/students understanding of the topics better.

Unfortunately, researchers have found that the practical activities in the school are not achieving the required objectives (Hodson 2004; Woolnough, 2007; Berry, Mulhall, Gunstone & Loughran, 2010). In his findings, Woolnough (2007) opined that practical work is not finding due emphasis in the schools in developing countries. According to him,the reasons attributed for this negligence of practical work are huge strength of science students in the classrooms, poor practical skills of science teachers, lack of time to plan science activities and experimental work and the system of examination that focuses on theory and gives less weightage to practical work. Berry, Mulhall, Gunstone and Loughran (2010) have remarked that the practical work performed in schools has failed in achieving its objectives. Hodson (2004) referred to the same issue and termed the practical work at school as ill conceived, confused and unproductive. He went on to say that the practical work contributes little to the students' learning in science. If something is not done to remedy this situation, the objectives of the Physics curriculum which is geared towards the development of any nation can never be achieved.

The constraints hindering effectiveness of practical work in physics according to Omeodu (2018) which negatively affects students' performance include quality of instruction use in the laboratory, inadequate and antiquated facilities, half-baked teachers/instructors, non-availability of laboratory and equipment's among others. Jegede, Okota & Eniayeju (1992) reported factors responsible for poor implementation of practical work in physics as; poor laboratory facilities, inadequate number of learning facilities among others. In their work, Ugwuanyi, Nwankwo and Ugwoke (2016) also attributed the ugly situation in Physics education to the following factors; inadequacy of materials and personnel, lack of laboratories and equipment, over usage of traditional approach to teaching, non-implementation of ICT in science teaching among others.

To address this generally observed problem of inadequate laboratory equipments and poor handling of the laboratory class, experiments can be done with modern innovations as a result of recent developments in Educational Technology. Supporting this, Yusuf and Yusuf (2009) in Agommuoh (2015) stated that application of Information, Communication and Technology (ICT) in physics education has the potential for enhancing the tools and environment for physics learning since it allows materials to be presented in multiple media, motivate and engage physics students in learning process, foster enquiry and exploration and provide access to world made information resources.

It is high time teachers go beyond traditional methods of doing practicals in physics and embrace innovations which does not depend on ample laboratory equipments and personnel to function. Apata (2017) defined innovation as the strategy of designing through excellent teaching methods, practices, techniques and technology to motivate students in learning. Innovation encompasses anything ICT as we all know. The purpose of ICT integration in physics teaching according to Meleisea (2007) in Nguyen, Williams and Nguyen (2012) is to help in creating, displaying, storing, manipulation and exchanging information. Also, research carried out by Mwanaszumbah and Magoma (2016) in Mwangi, Njoroge & Macharia (2020) showed that integrating ICT in physics teaching simplified abstract concepts and created interest in learners.

UNESCO, 2010 in Agommuoh and Ndirika (2017) said in their opinion that female students continue to lag behind in educational achievement and access, especially in secondary and tertiary where girls' enrolment, completion and achievement rates are low.In corroboration to this, Okeke (2007) noted that female under-representation and under achievement in the sciences especially in Physics is historical and has been about by several inter-related social cultural and interacting school factors which act jointly and singly to suppress female interest, enrolment, participation and achievement in science education at various levels of Nigerian education system. One of these factors according to Ndirika (2013) that is behind female students poor performance is science teaching strategies used by science teachers. According to her a change in status quo demands a change in pedagogies since women make up over half the workforce in the world (Adya & Kaiser, 2005) and science and technology education are viable tools for empowering women and girls. There is therefore the need to look out for innovative teaching methods that can improve students' performance irrespective of gender. The use of ICT tools in teaching quickly comes to mind. Rainer, Laosethakul and Aston (2003) as cited in Nwagbo and Ugwanyi (2015) stated that a number of recent studies evidenced that ICT-related differences between females and males lessened mainly in the access to ICT and basic computer skills. Physics teachers should therefore embrace the use of ICT tools (computers, television, radio, cell phone, video conferencing, internet etc) in teaching since learning has gone beyond the traditional method of talk and chalk. Video-Taped Instruction which anchors on computers to function in modern contemporary instructional technology is one area to be looked at.

Video as a media in education is as a result of innovations in modern day educational technology. Videotapes are produced from recordings made using video cameras. In their work, Shedrack and Robert (2016) found that students taught physics practical with Video-Taped Instruction performed better than their counterparts in the conventional group.

Ljubojevic, Vaskovic, Stankovic, and Vaskovic (2014) asserted that integration of video clips in teaching materials has recently attracted more attention in academic research. Kay (2012) cited in Reid and James (2018) also pointed out that video clips can be used in support of both practical and conceptual teaching through formats which include the video lecture, video tutorial, short knowledge clips, and "how-to" example-based video-modelling. In their work, Reid et al (2018) stated that the context of "ubiquitous learning", the opportunity of learning anywhere at any time, is being shown to be greatly supported by the advent of video. They went further to say that video-learning offers a cost-effective, location free method of flexible study, one that is available at all hours and can fit the individual needs of the learner, allowing them to learn at their own pace and view material repeatedly if necessary.

Schreiber, Fukuta and Gordon (2010) in Reid *et al* (2018) stated the following benefits of using video: the visual benefits of video provide a vehicle for increasing access to practical demonstrations; the visual and auditory nature of video stimulates the dual processing channels to enhance learning; the limitations of the working memory are eased by the ability to pause, rewind and repeatedly watch video; and finally video provides opportunities for interacting with interesting material, through attentive engagement with video content, which can be organizing and integrated with previous comprehension.

Despite these benefits of video inclusion in education, there are still numerous challenges to its integration into the classroom. Norton and Hathaway (2016) reiterated that video and multimedia production often requires more equipment, classroom time, personnel, and teacher training than is available in many schools. They went further to say that teachers report that the process of planning, recording, and editing digital videos is too time consuming to be used in any sustained way in their practice. Kirwan, Learmonth, Sayer, and Williams (2003) and Grahame and Simons (2004) as cited in Norton *et al* (2016) also reported little or no training in the training of teachers who are the ones to teach the students with video packages.

Papert (1993) an educational psychologist opined that learning should involve the use of visualization techniques. In his developmental theory of learning, he said that any visual delivery system capable of supporting learner interactivity while at the same time facilitating interconnectivity of images and symbols has the potential to become an extremely powerful educational tool because of the symbolic and connotative aspects of semantic learning (Bourne, Dominowski, Loftus & Healy, 1986).

According to the old Confucus' saying in Ajeyalemi (2011) I hear and I forget, I see and I remember, I do and I understand. This implies that when students are exposed to learning by seeing and doing during instruction they understand the learning task faster and apply it in the world of work.

Hofstein, Navon, Kipnis and Mamlok-Naaman (2005) argued that laboratory experiences that utilize various forms of visualization techniques would provide excellent opportunities for students not only to develop the understanding and reinforcement of physics concepts, but also to develop scientific investigation and inquiry skills at the same time. Honey and Moeller (1996) also opined that incorporating visualization techniques into the laboratory would provide an excellent opportunity for students to become involved in the active process of learning science. Video-Taped instruction is a visualization technique as we all know.

Hence, this study seeks to find out the effect of Video-Taped Instruction and Gender in Physics practical by senior secondary students in Port Harcourt metropolis.

1.1 Research Questions

i. What is the performance of male and female students in physics practical when taught using Video-Taped Instruction (VTI) and Conventional method (CM)?
ii. What is the interaction effect of gender (male and female) and teaching methods (Video-Taped Instruction and Conventional Method) on students' performance in practical physics?

1.2 Hypotheses

Ho_1 There is no significant difference between the performance of male and female students' taught practical physics using Video-Taped Instruction (VTI) and conventional method (CM).

Ho_2 There is no significant interaction effect between gender (male and female) and teaching methods (VTI and CM) on student's performance in practical physics.

II. METHODOLOGY

This study was carried out among senior secondary school students in Port Harcourt Local Government Area of Rivers State. The study is a quasi-experimental research of the type pretest posttest control group design**.** The population of this study comprised all the Senior Secondary class three (SS3) students who offered physics in the 9 public schools in Port Harcourt metropolis numbering one thousand two hundred and thirty eight (1238), (Statistics Unit, Post Primary Schools Management Board, Port Harcourt). Purposive sampling was used to select two co-educational schools in Port-Harcourt. Two intact classes of 47 and 56 which gave a total of 103 S.S. 3 students made up the sample size. This sample is made up of 57 boys and 46 girls. The research subjects were not randomized due to problems of re-arrangement of intact classes. The instrument used was the Physics Practical Skills Rating Scale (PPSRS) which was an adaptation of Chemistry Practical Skills Rating Scale (CPSRS) developed by Njoku (1999). CPSRS measured 8 skills but the researcher with the help of a physics laboratory technologist used 6 from it and added four more which made a total of 10 skills. The test item consist of a physics practical question, which is to determine the acceleration due to gravity (g) through the simple pendulum experiment.

III. RESULTS

Mean and standard deviation (SD) were used to answer research question 1.Data obtained were analyzed from the posttest scores of the practical physics test administered after treatment. The results are presented in Table 1.

Table 1: Mean and Standard Deviation of the Post Test Mean Scores of the Students' in Both the VTI and CM Groups

Group	Sex	N	Post test mean	SD	Mean difference
VTI	Male Female	26 21	73.00 80.14	15.24 17.08	(-7.4)
CM	Male Female	31 25	70.45 62.32	20.71 21.29	(8.13)

VTI = Video Taped Instruction = Experimental group
CM = Conventional Method = Control group

The results on Table 1, shows that in the VTI group the post tests mean and SD for male students was 73.00 and 15.24 respectively while that of female students was 80.14 and 17.08 respectively. This indicates that female students scored higher than male students in the VTI group. In the CM group, male students had mean value of 70.45 and standard deviation of 20.71 while female students had mean of 62.32 and standard deviation of 21.29. These values show that male students scored higher than female students in the CM group. Furthermore, the mean difference between male and female students in the VTI group was (-7.14) while that of CM group was (8.13). For valid decision to be taken on the influence of gender on performance of students in the VTI and CM group, hypothesis one was tested.

Research Question 2:

Mean and standard deviation (SD) were deployed to answer research question 2.Data obtained were analyzed from the posttest scores of the practical physics test administered after treatment. The results are presented in Table 2.

Table 2: Mean and Standard Deviation of the Post Test Scores of the Students' Showing the Interaction of Gender and Methods

Gender	Groups			
	VTI		CM	
	Mean	SD	Mean	SD
Male	73.00	15.24	70.45	20.72
Female	80.14	17.08	62.32	21.29

VTI = Video Taped Instruction = Experimental group
CM = Conventional Method = Control group

Table 2 shows the mean of male students in both VTI and CM to be 73.00 and 70.45 respectively while that of female was 80.14 and 62.32 respectively. In both cases there is an increase in students' performance but in favour of female students. Also, the performance in both VTI and CM were different but in favour of VTI. The result is that there is interaction effect between gender and teaching methods on students' performance in practical physics.

Table 3: A t-test Analysis of Gender Difference in the Post Test Mean Scores of Physics Students' Exposed to VTI and CM Groups

Groups	Gender	N	X	SD	df	t-cal	Sig (0.05)
	Male	26	73	15.24			
VTI					45	-1.51	0.14 NS
	Female	21	80.14	17.08			
	Male	31	70.45	20.72			
CM					54	1.44	0.16 NS
	Female	25	62.32	21.29			

NS = Not significant, P > 0.05 level of significance
VTI = Video Taped Instruction = Experimental group
CM = Conventional Method = Control group

Table 3 shows that the calculated t-value (-1.51) for male and female students' in VTI group is not significant at 0.05 level of significance. Therefore the null hypothesis was accepted with respect to VTI group. In the same vein the calculated t-value (1.44) for male and female students' in CM group is also not significant at 0.05 level of significance. Therefore, the null hypothesis was accepted. The result is that there is no significant difference between the performance of male and female students' taught practical physics using Video-Taped Instruction (VTI) and conventional method (CM)

Table 4: Two–Way Analysis of Variance (2 x 2 – ANOVA) on the Post-Test Mean Scores of Students' on Interaction Effect of Methods (Groups) and Gender

SV	SS	df	MS	F-ratio	Sig (0.05)
Groups (VTI and CM)	2620.886	1	2620.886	7.331*	0.008
Gender (Sex)	6.174	1	6.174	0.017	0.896 NS
Groups*Gender	1473.484	1	1473.484	4.122*	0.045
Error	35391.689	99	357.492		
Total	39492.233	102			

*Significance at P < 0.05 level of significance
NS = Not significant
VTI = Video Taped Instruction = Experimental group
CM = Conventional Method = Control group
SV = Source of variation
SS = Sums of squares
df = Degree of freedom
MS = Mean square

Table 4 which shows the summary of the Analysis of variance results on the interaction effects of groups and gender performed on the post test scores of the students' performance in practical physics. The results revealed that the F-ratio (4.122) for the interaction effect is significant at 0.05 level of significance. Therefore the null hypothesis was rejected. That is, there is significant interaction effect between gender (male and female) and teaching methods (VTI and CM) on students' performance in practical physics.

IV. DISCUSSION OF FINDINGS

The study revealed that (see Table 3) there was no significant difference between the performance of male and female students exposed to the video-taped instruction and the conventional method. This agrees with the findings of Israel (2007) and Omiola, Enuwa, Awoyemi and Bada, (2012) who found that there was no significant difference between the male and female students' performance when taught with video-taped instruction. According to them, students' performance, whether boys or girls is determined by their ability to achieve. Also, performance of male and female students' were greatly improved on the use of VTI which means that the use of it is independent of gender.

When the variables of treatment and gender were interacted as shown in Table 4 there was an interaction effect between the teaching methods and gender. Therefore the null hypothesis 2 was rejected. This contradicts the findings of Israel (2007) and Omiola *et al* (2012). According to them, there is actually no significant interaction effect between the teaching methods and gender in students' performance in practical physics.

V. CONCLUSION

From the findings of this study, the following conclusion was made:-

The mean achievement scores of both male and female students' were greatly improved on the use of video-taped instruction establishing that it is independent of gender.

Educational Implication of the Study

Every nation needs both men and women to acquire basic literacy, essential skills and attitudes in Physics as a preparation for technological application of Physics. For this purpose, methods of teaching that improves performance of students irrespective of gender should be embraced by Physics teachers otherwise a nation can fall short of the manpower needed to serve its nation. From the literature, it was said that female students' performance in Physics has been poor over the years and we know that females constitute a greater number of the population in any society. When this continues to happen it is the society that will suffer since the workforce needed to provide for functional living in the society will be lacking.

VI. RECOMMENDATIONS

Based on the findings of this study, the researcher wishes to make the following recommendations.

1. Video-taped instruction as a method of teaching should be included in the senior secondary physics curriculum since it improved students' performance irrespective of gender.
2. Physics teachers should gear towards the production of video-taped instructional packages that can be used in physics practical. This will tackle the problem of shortage or lack of practical equipments and personnel challenges.
3. Curriculum planners should create a forum to raise experts who will be producing video-taped instructional packages. These experts can then be used as resource persons in the training of physics teachers during workshops and seminars.
4. Professional educational bodies should arrange workshops and seminars in the training of physics teachers on the use of video-taped instruction to keep them abreast with modern innovative teaching strategies.
5. Finally, government should do more through funding by providing well furnished ICT centres and computer classrooms in our secondary schools to enable teachers and students teach and learn with video-taped instruction. In addition, adequate and regular power supply is very indispensable in the execution of video-taped instruction. This calls for installment of plants in our school systems.

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